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I-091

UNIVERSITY OF CALIFORNIA, DAVIS

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SANTA BARBARA • SANTA CRUZ

COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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DAVIS, CALIFORNIA 95616

July 25, 1997

Ms. Kate Hansel
CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

Dear Ms. Hansel,

Enclosed please find an original plus nine copies of an inquiry proposal titled, "Temperature Control to Enhance Central Valley Fisheries." I will appreciate your evaluation of this inquiry proposal for consistency with the mission of the CALFED Bay-Delta Program.

If you have any questions, please call me at (916) 752-1424, or you may reach me via e-mail at gtorlob@ucdavis.edu. I look forward to receiving your reply.

Sincerely yours,

Gerald T. Orlob
Professor Emeritus
Civil and Environmental Engineering

First Input _____
Second Input _____

CALFED CATEGORY III PROPOSAL REVIEW - RFP #1 (v3, 7/30/97)
July/Aug 1997

Proposal # ~~FI-098~~ Applicant UC - Davis

Inquiry FI-091

MINIMUM REQUIREMENTS

APPLICANT

1. Applicant/Organization

2. Applicant Type (must include one of types 1-5, may also include one of types a-g)
   1. California State Agencies (include in-state universities)
   2. Federal Agencies
   3. Non-profit Organizations
   4. Other Private Entities
      a. Consulting firm
      b. Individual
      c. Other
   5. Other Public Agencies (includes out-of-state universities)
      a. Educational Institution
      b. Resource Conservation District
      c. Irrigation/Water Distric
      d. Reclamation District
      e. City
      f. County
      g. Other

3. Name

4. Address

5. City

6. State

7. Zip Code

8. Phone

I-007804

9. Fax

10. Email

DESCRIPTION

1. RFP Group Type
    1. Public Works/Construction
    2. Land Acquisition
    3. Other Services

2. County

3. Requested Amount (in thousands)

4. Cost Share Amt (in thousands)

5. Cost Share Partners
    a. CVPIA
    b. Four Pumps
    c. Tracy Fish Agreement
    d. Applicant

6. Duration of Category III Funding 0.5 1.0 1.5 2.0 2.5 3.0 years

TECHNICAL REVIEW

Reveiwed by dg

Is project in ERPP Study Area? No
Note: If project is not in ERPP Study Area, project does not pass initial review, no further review needed. Return to support staff.

PROJECT TYPE - pgs 6-7 circle all that apply, mark a P next to the Primary category. If proposal clearly breaks out dollars by category, fill out additional sheets for each category with dollar amount indicated.

1. Watershed Management Planning & Implementation
2. Construction
3. Land Acquisition
4. Aquatic and Terrestrial Habitat Restoration
5. Water Quality
6. Monitoring, Assessment and Reporting (site specific or large scale)
7. Research
8. Education
9. Operations and Maintenance

WATERSHED (MUST select one or more of types 1-22, may also include one or more of type a-y) If proposal clearly breaks out dollars by region, fill out additional sheets for each region with dollar amount indicated.

1. Sacramento-San Joaquin Delta
    a. North Delta
    b. East Delta
    c. South Delta
    d. Central and West Delta
2. Suisun Marsh/North San Francisco Bay
    a. Suisun Bay and Marsh
    b. Napa River
    c. Sonoma Creek
    d. Petaluma River
    e. San Pablo Bay
3. Sacramento River
    a. Keswick Dam to Red Bluff Diversion Dam
    b. Red bluff Diversion Dam to Chico Landing
    c. Chico Landing to Colusa
    d. Colusa to Verona
    e. Verona to Sacramento
4. North Sacramento Valley
    a. Clear Creek

b. Cow Creek
c. Bear Creek
d. Battle Creek

5. Cottonwood Creek
    a. Upper Cottonwood Creek
    b. Lower Cottonwood Creek
6. Butte Basin
    a. Paynes Creek
    b. Antelope Creek
    c. Mill Creek
    d. Deer Creek
    e. Big Chico Creek
    f. Butte Creek
    g. Butte Sink
7. Colusa Basin
    a. Stony Creek
    b. Elder Creek
    c. Thomes Creek
    d. Colusa Basin
8. Feather River/Sutter Basin
    a. Feather River
    b. Yuba River
    c. Bear River and Honcut Creek
9. American River
10. Yolo Basin
    a. Cache Creek
    b. Putah Creek
    c. Solano
11. Eastside Delta Tributaries
    a. Cosumnes River
    b. Mokelumne River
    c. Calaveras River
12. San Joaquin River
    a. Vernalis to Merced
    b. Merced to Mendota Pool
    c. Mendota Pool to Gravelly Ford
    d. Gravelly Ford to Friant
13. East San Joaquin Basin
    a. Stanislaus River
    b. Tuolumne River
    c. Merced River
14. West San Joaquin Basin
15. North Sacramento River Watershed

16. East Sacramento River Watershed
17. West Sacramento River Watershed
18. San Joaquin River Watershed
19. South and Central San Francisco Bay
20. Fresno Sough/Mendota Sub Region
21. Ocean
22. Not Applicable

HABITAT - pgs 20-23 (circle all that apply)

1 Tidal perennial aquatic habitat (freshwater)
2 Seasonal wetland and aquatic
3 Instream aquatic
4 Shaded riverine aquatic
5 Saline emergent wetlands (tidal)
6 Midchannel islands and shoals
7 North Delta agricultural wetlands and perennial grasslands
8 Not applicable

SPECIES - pgs 23-24 (circle all that apply)

1 San Joaquin river and east-side tributary fall-run chinook salmon
2 Late-fall run chinook salmon
3 Winter-run chinook salmon
4 Spring-run chinook salmon
5 Delta smelt
6 Longfin smelt
7 Splittail
8 Steelhead trout
9 Green sturgeon
10 Striped bass
11 Migratory birds
12 Not applicable

STRESSOR CATEGORY AND SUBCATEGORY - pgs 25-33 (MUST select one of type 1-13, and may select subcategories)

1 Alteration of flows and other effects of water management
    1.1 Hydrograph alterations
    1.2 Entrainment
        1.2.1 Fish Screens
        1.2.2 Other Entrainment
    1.3 Migration barriers and straying
2 Floodplain and marshplain changes
    2.1 Hydrological isolation of floodplain

5. Alteration of channel form or meander - includes channel aggradation due to increase in fine sediments, channel form changes, prevention of meander, loss or reduction of riparian zone, isolation of side channels and tributaries
6. Reduction of gravel recruitment
7. Water quality - includes increase contaminants, salinity, and nutrient or carbon input
8. Water temperature
9. Invasive plants
10. Invasive organisms
11. Adverse fish and wildlife harvest impacts
12. Artificial propagation of fish
13. Land use changes - includes grazing, gravel mining, urbanization, forestry and agricultural practices
14. Wildfire
15. Human disturbance - includes disturbance of fish and wildlife populations by anglers, boaters and other recreational users

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Inquiry Proposal

TEMPERATURE CONTROL TO ENHANCE CENTRAL VALLEY FISHERIES

G. T. Orlob, Department of Civil and Environmental Engineering
University of California Davis. Davis, CA 95616
(916) 752-1424; Fax: (916) 752-7872; gtorlob@ucdavis.edu

Project Description

Water temperature is perhaps the most important environmental characteristic governing the natural reproductive success of aquatic species in surface water systems of the Central Valley. Within species-specific ranges temperature influences the reproductive success of anadromous salmon, Delta smelt, striped bass, splittail and many others in the aquatic environment. It governs the rates of chemical and biological processes, heat exchanges between air and water, and physical properties of water that affect hydrodynamic behavior. While water temperatures in surface water systems are strongly influenced by local meteorological conditions, they are governed as well by operation of project facilities that impound and regulate flows to downstream uses. Retention of water in reservoirs like Shasta, Trinity, Whiskeytown, Oroville and Folsom results in thermal stratification, thus affecting the availability of cold water required for salmon spawning in the upper reaches of the Sacramento and Feather rivers and their tributaries and influencing the environment of warm water species in the Delta. Constructed facilities like the inlet control structure recently installed on Shasta Dam, the adjustable outlet structure on Oroville Dam and the temperature curtains in Whiskeytown Reservoir are examples of measures specifically directed to improving salmon spawning habitat. The efficacy of these devices and the project operating rules determining flows and temperatures in downstream reaches of regulated rivers are the subjects of this proposal.

Objectives

The primary objective of the proposed project will be improved project operation for the control of water temperatures and the maintenance of suitable habitat for aquatic species indigenous to the surface water systems of the northern Central Valley and the Delta. It is proposed to achieve this objective through the application of a suite of existing mathematical models that have been specifically designed to simulate the hydrodynamic and temperature responses of such systems to flow regulation and meteorological conditions that affect heat energy exchanges at the air-water interface. The suite of models includes WQRRS (1D temperature), RMA2 and RMA10 (hydrodynamics), RMA11 (water quality) and a particle tracking model for the Sacramento River and the Delta. Over the past several years the Water Resources and Environmental Modeling Group at UC Davis has developed, calibrated, verified and demonstrated the applicability of models of Shasta, Trinity and Keswick reservoirs and the Sacramento and Feather rivers from their upstream impoundments to their confluence near Verona, just upstream of the Delta. Additionally, these models are now being applied in studies of the fate of striped bass in the Delta system. A new model of the three-dimensional hydrodynamics of Whiskeytown Reservoir, an important feature of the Shasta-Trinity Division of the CVP that figures prominently in temperature control strategies, is under development. Collectively, these models provide a unique capability for evaluation of the efficacy of alternative operation scenarios and the development of the best available technology for temperature control.

Scope of Work and Schedule

To meet the objectives posed above it will be necessary to execute a series of specific tasks, as follows: (1) assemble and evaluate existing morphological, hydrological and meteorological data necessary for updating model geometry and boundary conditions; (Note: calibrations and verifications in the Sacramento River Temperature Modeling Project were limited to data sets for only the months of August 1993 and 1994); (2) identify data gaps and supplement the data base supporting the models, i.e., extend it to include at least five summer months; (3) update the model grids with current cross section and bathymetric data; (4) recalibrate the models for the extended data set; (5) identify and select water years and operation scenarios representative of normal and extreme hydrological and meteorological conditions likely to influence water temperatures; (6)

simulate system performance for the range of conditions identified in (5); (7) identify hydrodynamic, and meteorological conditions and specific locations that produce critical conditions for temperature sensitive species; (8) develop preferred operation rules for project facilities to meet temperature targets for the conditions and locations identified in (7); (9) develop temperature-flow relationships for major project facilities; (10) assess the efficacy of specific temperature control devices and measures; (11) document all project accomplishments. It is expected that the tasks outlined above can be completed in a period of three years from the start of the project.

Expected Benefits

The principal benefit of the proposed project will be improved operation of project facilities in the interest of water temperature control . The project will provide the means for quantitative determination of the effectiveness of temperature control devices, singly or collectively, in meeting temperature targets. It will contribute to improved project efficiency and water conservation.

Products

Principal products of the project will be improved hydrodynamic and temperature models capable of simulating the responses of various individual project facilities and an integrated water resource management system, to changes in hydrologic, meteorological, and operating conditions. A detailed project report will document the models, the data base, recommended project operating rules and other project accomplishments.

Project Justification

The reproductive success of several races of chinook salmon and steelhead trout in the rivers and tributary streams of northern California and of several warm water species in the Sacramento-San Joaquin Delta is strongly influenced by water temperatures, which are in turn governed by flows released from project facilities and local meteorological conditions. Decisions concerning operation of existing project facilities for temperature control require explicit knowledge of the complex relationships between these variable quantities that can be supplied by the mathematical models to be employed in this project. Application of the models is expected to improve project operation.

Level of Effort and Budget Cost

It is estimated that the level of effort required over the three-year duration of the proposed project would be equivalent to 5 person-years, which at PRGE rates at UC Davis would cost approximately $200,000 over the three-year project period. With reasonable allowance for travel, supplies, equipment, computer costs and overhead (44.5%), the total project cost is estimated at $300,000, or $100,000 per year.

Applicant Qualifications

This project would be supported by many years of experience of the principal investigators, Drs. G. T. Orlob and I. P. King, in development and application of mathematical models for investigation of the hydrodynamic and water quality behavior of surface water systems. This experience includes modeling studies of many features of the Central Valley water resource system, e.g., the Sacramento and Feather Rivers; Shasta, Trinity, Keswick, and Whiskeytown reservoirs; the Sacramento-San Joaquin Delta; and San Francisco Bay. The models proposed to be utilized in this project are original contributions of the principal investigators and their students at UC Davis. Graduate student participants in the proposed project will be experienced in modeling of surface water systems and in field survey techniques required to develop necessary supporting data.

Program Coordination and Project Leverage

The models which would be utilized and refined in the proposed project are in the public domain, having been developed in part by public funds. They are provided by agreement and cooperation of the University and sponsoring agencies. Collaboration with other state agencies, such as the Departments of Fish and Game and Water Resources, and federal agencies like EPA, USFWS, and the U. S. Bureau of Reclamation has been a long standing practice of the UCD Modeling Group and is expected to continue during the course of the proposed project if it is funded.